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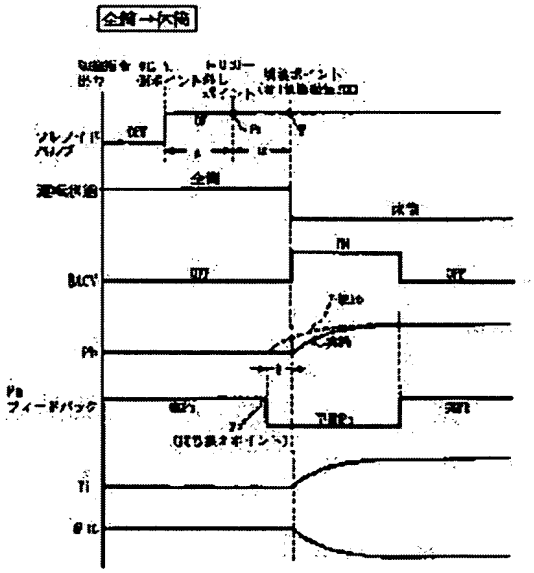
(54) CYLINDER-HALTED ENGINE CONTROLLER

(57)Abstract:

PROBLEM TO BE SOLVED: To effectively prevent torque shocks in changing over an engine between an operation on its full cylinders and an operation with its cylinders halted.

SOLUTION: In order to prevent torque shocks in changing over an engine from an operation on its full cylinders to an operation with its cylinders halted, an electronic air control valve(EACV) is opened as well as an injection quantity Ti and ignition timing θIG are controlled on the basis of an actual intake back pressure Pb detected by a detector means. Since the use of an actual intake back pressure Pb at transition in the changeover complexes proper control, an injection quantity Ti and ignition timing θIG are controlled on the basis of a predicted intake back pressure Pb stored in advance at a shifted position precedent to the changeover point by a delay period B. That shifted point is returned to the original control using an actual intake back pressure Pb when the actual intake back pressure Pb becomes equal to the predicted intake back pressure Pb after the completion of the changeover.



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* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the control unit for preventing generating of a torque shock especially at the time of a change-over of all cylinder operations / partial cylinder operation about the gas column pause engine equipped with the gas column pause device which switches all cylinder operations that operate all of two or more gas columns, and the partial cylinder operation which stops actuation of a part of said gas column.
[0002]
[Description of the Prior Art] The technique of preventing generating of a torque shock at the time of a change-over of all cylinder operations / partial cylinder operation is well-known by JP,63-21812,B and JP,62-103430,A.
[0003] Drawing 14 shows change of the engine torque to change of throttle opening about the time of all cylinder operations and partial cylinder operation. Since the throttle opening and the engine torque of all cylinder operations and partial cylinder operation are in agreement, what was indicated by said JP,63-21812,B has avoided generating of a torque shock on the intersection a of both Rhine by switching all cylinder operations and partial cylinder operation by the operational status corresponding to said a points, so that clearly from this drawing.
[0004] Moreover, what was indicated by said JP,62-103430,A has avoided generating of a torque shock by controlling throttle opening in b points and c points of drawing 14 so that the engine torque at the time of all cylinder operations and the engine torque at the time of partial cylinder operation may be in agreement to the same accelerator opening.
[0005]
[Problem(s) to be Solved by the Invention] However, some which were indicated by said JP,63-21812,B have the problem which can switch all cylinder operations / partial cylinder operation only by the specific operational status whose engine torque at the time of all cylinder operations and partial cylinder operation corresponds. Moreover, since what was indicated by said JP,62-103430,A is in the response of inhalation-of-air negative pressure to change of throttle opening even if it tends to control throttle opening and tends to avoid generating of a torque shock at the time of a change-over of all cylinder operations / partial cylinder operation, there is [a problem that it is difficult to fully avoid generating of a torque shock].
[0006] This invention was made in view of the above-mentioned situation, and aims at preventing effectively generating of the torque shock at the time of a change-over of all cylinder operations / partial cylinder operation.
[0007]
[Means for Solving the Problem] In addition to the time of a change-over of all cylinder operations / partial cylinder operation, a control means controls engine power by invention indicated by claim 1 based on the inhalation air content detected with the inhalation air content detection means. At the time of a change-over of all cylinder operations / partial cylinder operation, a control means is replaced with the inhalation air content detected with said inhalation air content detection means, and controls engine power based on the prediction inhalation air content set up beforehand. Thereby, engine power can be controlled the optimal to the transient between all cylinder operations and partial cylinder operation, and generating of a torque shock can be avoided.

[0008] In addition to the time of a change-over of all cylinder operations / partial cylinder operation, a control means controls throttle opening by invention indicated by claim 2 according to all cylinder operations and partial cylinder operation. At the time of a change-over of all cylinder operations / partial cylinder operation, a control means amends throttle opening so that the response delay of an inhalation air content may not arise. Thereby, engine power can be controlled the optimal to the transient between all cylinder operations and partial cylinder operation, and generating of a torque shock can be avoided.
[0009]
[Embodiment of the Invention] Hereafter, it explains based on the example of this invention which showed the gestalt of operation of this invention to the accompanying drawing.
[0010] The top view of the engine with which drawing 1 - drawing 10 show the 1st example of this invention, and drawing 1 was carried in the car, The outline block diagram of an inhalation-of-air system and drawing 3 drawing 2 R> 2 The top view of the cylinder head of a right bank, Drawing 4 the operation explanatory view of a trigger, and drawing 6 for the important section enlarged drawing of drawing 3 , and drawing 5 The 1st minute Fig. of a flow chart, Drawing 7 R> 7 is a graph with which in the 2nd minute Fig. of a flow chart, and drawing 8 the timing diagram at the time of all cylinder operation -> partial-cylinder-operation change-overs and drawing 9 show the timing diagram at the time of a partial-cylinder-operation -> all change-over [cylinder operation], and drawing 10 shows fluctuation of an air-fuel ratio.
[0011] The engine E longitudinally carried in the car-body anterior part of an automobile as shown in drawing 1 is a V type six cylinder engine, and is the right bank BR. ** 1 cylinder C1, ** 2 cylinder C2, and ** 3 cylinder C3 While having, it is the left bank BL. ** 4-cylinder C4, ** 5-cylinder C5, and ** 6-cylinder C6 It has. At the time of the low loading of Engine E, it is the right bank BR. ** 1 cylinder C1, ** 2 cylinder C2, and ** 3 cylinder C3 Operation is stopped and it is the left bank BL. ** 4-cylinder C4, ** 5-cylinder C5, and ** 6-cylinder C6 Partial cylinder operation to operate is performed and they are ** 1 cylinder C1 - ** 6-cylinder C6 at the time of the heavy load of Engine E. All cylinder operations that operate all are performed.
[0012] As shown in drawing 2 , they are # 1 cylinder C1 - # 6-cylinder C6. The throttle valve 3 by which a closing motion drive is carried out with the actuator 2 which consists of a pulse motor is formed in the inhalation-of-air path 1 which stands in a row. EACV5 which controls the flow rate of the supplementary air which bypasses this throttle valve 3 is formed in the bypass path 4 which connects the upstream and the downstream of a throttle valve 3.
[0013] oil pressure POIL of the oil in which the oil pump 41 mentioned later carries out the regurgitation An oil pressure detection means S1 to detect from -- with a signal oil temperature TOIL of the oil in which an oil pump 41 carries out the regurgitation An oil-temperature detection means S2 to detect from -- with a signal an engine-speed detection means S3 to detect an engine speed Ne from -- with a signal It is inputted into electronic control unit U which the signal from inhalation-of-air negative pressure detection means S4 which detects the inhalation-of-air negative pressure Pb becomes from a microcomputer. Electronic control unit U is based on said oil pressure POIL, an oil temperature TOIL, an engine speed Ne, and the inhalation-of-air negative pressure Pb, and the opening of EACV5 and ignition plug 6 -- are ignition timing and a fuel injection valve 7. -- Fuel oil consumption and the actuation of solenoid valves 45i and 45e mentioned later are controlled.
[0014] Next, it is based on drawing 3 and drawing 4 , and is the right bank BR. ** 1 cylinder C1, ** 2 cylinder C2, and ** 3 cylinder C3 The structure of a valve gear is explained.
[0015] it is shown in drawing 3 -- as -- right bank BR ** 1 cylinder C1, ** 2 cylinder C2, and ** 3 cylinder C3 **** -- although gas column pause device 11 -- is prepared, respectively -- since the structure is the same -- as a representative -- # 1 cylinder C1 The gas column pause device 11 is explained. It connects with the crankshaft which is not illustrated and the cam shaft 12 arranged along with the longitudinal direction of the cylinder head is driven at 1/2 of the rotational frequencies of this crankshaft. Inhalation-of-air rocker-shaft 13i and exhaust air rocker-shaft 13e are supported in parallel by the right-and-left both sides of a cam shaft 12.
[0016] Air inlet cam 14i and exhaust cam 14e adjoin, it is prepared in the cam shaft 12, and the cams 15 and 15 for a pause of the pair which has only a base circle on both sides of these air inlet cam 14i and exhaust cam 14e are formed so that clearly from drawing 4 . While inhalation-of-air rocker-arm

16i and the rocker arms 17 and 17 for a pause of the pair located in the both sides are supported pivotably by inhalation-of-air rocker-shaft 13i free [rocking] and roller 18i which can contact said air inlet cam 14i is prepared in the end face of inhalation-of-air rocker-arm 16i, the rollers 19 and 19 which can contact the cams 15 and 15 for a pause are formed in the end face of the rocker arms 17 and 17 for a pause. And the tip of the rocker arms 17 and 17 for a pause of a pair is # 1 cylinder C1. The stem end of the inlet valves 20i and 20i of a pair is contacted.

[0017] The 1st two piston 21 and 21 each, the 2nd piston 22 and 22, and stopper pins 23 and 23 are supported free [sliding] inside the cylinder hole which penetrates inhalation-of-air rocker-arm 16i and the rocker arms 17 and 17 for a pause of a pair on the same axle. The 1st piston 21 and 21 is arranged back to back inside the cylinder hole of inhalation-of-air rocker-arm 16i, and is driven in the direction which deserts mutually with the oil pressure supplied from oilway 24i formed in the interior at inhalation-of-air rocker-shaft 13i. The 2nd piston 22 and 22 of the pair arranged on the outside of the 1st piston 21 and 21 is movable in between the connection location over the cylinder hole of inhalation-of-air rocker-arm 16i, and the cylinder hole of the rocker arms 17 and 17 for a pause, and the deconcatenation locations extruded by the cylinder hole of the rocker arms 17 and 17 for a pause from the cylinder hole of inhalation-of-air rocker-arm 16i. The stopper pins 23 and 23 of the pair of the 2nd piston 22 and 22 which has been arranged further outside and contained in the cylinder hole of the rocker arms 17 and 17 for a pause are energized in the direction which contacts the 2nd piston 22 and 22 by springs 25 and 25, respectively.

[0018] The 1st two piston 21 and 21 each, the 2nd piston 22 and 22, and stopper pins 23 and 23 are supported free [sliding] inside the cylinder hole which penetrates exhaust air rocker-arm 16e and the rocker arms 17 and 17 for a pause of a pair on the same axle. The 1st piston 21 and 21 is arranged back to back inside the cylinder hole of exhaust air rocker-arm 16e, and is driven in the direction which deserts mutually with the oil pressure supplied from oilway 24e formed in the interior at exhaust air rocker-shaft 13e. The 2nd piston 22 and 22 of the pair arranged on the outside of the 1st piston 21 and 21 is movable in between the connection location over the cylinder hole of exhaust air rocker-arm 16e, and the cylinder hole of the rocker arms 17 and 17 for a pause, and the deconcatenation locations extruded by the cylinder hole of the rocker arms 17 and 17 for a pause from the cylinder hole of inhalation-of-air rocker-arm 16i. The stopper pins 23 and 23 of the pair of the 2nd piston 22 and 22 which has been arranged further outside and contained in the cylinder hole of the rocker arms 17 and 17 for a pause are energized in the direction which contacts the 2nd piston 22 and 22 by springs 25 and 25, respectively.

[0019] Migration of the 2nd piston 22 which joins together or cancels [joint] inhalation-of-air rocker-arm 16i and exhaust air rocker-arm 16e at the rocker arm 17 for a pause is regulated by the trigger 27 which is interlocked with rocking of inhalation-of-air rocker-arm 16i and exhaust air rocker-arm 16e, and moves. That is, when the 2nd piston 22 is in the connection location shown in drawing 5 (A), a trigger 27 is the 1st stop slot 211 of the 1st piston 21. It was engaged, and migration of this 1st piston 21 is regulated, therefore the 2nd piston 22 is also fixed to said connection location. if the lift (rocking to the direction which opens inlet-valve 20i and exhaust valve 20e) to the valve-opening direction of inhalation-of-air rocker-arm 16i and exhaust air rocker-arm 16e reaches a trigger blank lift -- a trigger 27 -- the direction of an arrow head -- retreating -- the 1st stop slot 211 of 1st piston 21 -- from -- it breaks away and 1st piston 21 -- will be in a movable condition. Moreover, when the 2nd piston 22 is in the deconcatenation location shown in drawing 5 (B), a trigger 27 is the 2nd stop slot 212 of the 1st piston 21. It was engaged, and migration of this 1st piston 21 is regulated, therefore the 2nd piston 22 is also fixed to said deconcatenation location. if the lift to the valve-opening direction of inhalation-of-air rocker-arm 16i and exhaust air rocker-arm 16e reaches a trigger blank lift -- a trigger 27 -- the direction of an arrow head -- retreating -- the 2nd stop slot 212 of 1st piston 21 -- from -- it breaks away and 1st piston 21 -- will be in a movable condition.

[0020] In addition, in drawing 3 , the oilways 26i and 26e prepared in inhalation-of-air rocker-shaft 13i and exhaust air rocker-shaft 13e are oilways which refuel an oil tappet.

[0021] When oil pressure is not supplied to oilway 24of inhalation-of-air rocker-shaft 13i i by the above-mentioned configuration, the 2nd piston 22 and 22 of the pair energized by the resiliency of springs 25 and 25 is in the connection location shown in drawing 5 (A), and has combined

inhalation-of-air rocker-arm 16i with the rocker arms 17 and 17 for a pause of a pair at one. Therefore, if inhalation-of-air rocker-arm 16i which made roller 18i contact air inlet cam 14i prepared in the cam shaft 12 rocks to the circumference of inhalation-of-air rocker-shaft 13i, the rocker arms 17 and 17 for a pause of the pair combined with it and one will rock, and the closing motion drive of the inlet valves 20i and 20i will be carried out. When inlet valves 20i and 20i carry out a lift, the rollers 19 and 19 of the rocker arms 17 and 17 for a pause desert the cams 15 and 15 for a pause which consist of a base circle.

[0022] When oil pressure was supplied to oilway 24of inhalation-of-air rocker-shaft 13i i and inhalation-of-air rocker-arm 16i rocks even a trigger blank lift triggers 27 and 27 -- the 1st stop slot 211 and 211 Separate, and the 1st piston 21 and 21, the 2nd piston 22 and 22, and stopper pins 23 and 23 resist springs 25 and 25, and move to the location of drawing 5 (B). from -- The 2nd piston 22 and 22 arrives at a deconcatenation location, and connection to inhalation-of-air rocker-arm 16i and the rocker arms 17 and 17 for a pause is canceled. Consequently, the rocker arms 17 and 17 for a pause which made rollers 19 and 19 contact the cams 15 and 15 for a pause which rocking of inhalation-of-air rocker-arm 16i was no longer transmitted to the rocker arms 17 and 17 for a pause, and were equipped only with the base circle stop rocking, and inlet valves 20i and 20i are held at a clausilium condition.

[0023] When oil pressure was extracted from oilway 24of inhalation-of-air rocker-shaft 13i i and inhalation-of-air rocker-arm 16i rocks even a trigger blank lift triggers 27 and 27 -- the 2nd stop slot 212 and 212 Separate and the 1st piston 21 and 21, the 2nd piston 22 and 22, and stopper pins 23 and 23 move to the location of drawing 5 (A) by the resiliency of springs 25 and 25. from -- The 2nd piston 22 and 22 arrives at a connection location, and inhalation-of-air rocker-arm 16i and the rocker arms 17 and 17 for a pause are connected. Consequently, rocking of inhalation-of-air rocker-arm 16i comes to be transmitted to the rocker arms 17 and 17 for a pause, and the closing motion drive of the inlet valves 20i and 20i is again carried out with rocking of inhalation-of-air rocker-arm 16i.

[0024] As mentioned above, although actuation of inlet valves 20i and 20i was explained, since actuation of exhaust valves 20e and 20e is also substantially the same, the overlapping explanation is omitted.

[0025] The oil pump 41 driven with Engine E refuels the oilway 42 which stands in a row in the lubrication system of each part of engine E, the oilway 43 of gas column pause device 11 -- which stands in a row in Oilways 24i and 24e, and the oilway 44 which stands in a row in the oilways 26i and 26e of an oil tappet so that clearly from drawing 3 . Solenoid valves 45i and 45e are formed in the oilways 43i and 43e which branch to two forks from the oilway 43 prolonged from an oil pump 41, and stand in a row in oilway 24of oilway 24i and exhaust air rocker-shaft 13e of inhalation-of-air rocker-shaft 13i e, respectively. It consists of a normally closed valve, if a solenoid is excited, it will open, and gas column pause device 11 -- operates, and solenoid valves 45i and 45e are # 1 cylinder C1 - # 3 cylinder C3. Actuation can be stopped.

[0026] Next, an operation of the example of this invention equipped with the above-mentioned configuration is explained.

[0027] Engine E Since the direction at the time of a heavy load is possible for operation with thermal efficiency higher than the time of low loading, The bank BL of right and left at the time of a heavy load, and BR # 1 cylinder C1 - # 6-cylinder C6 All cylinder operations that operate all are performed. At the time of low loading, it is the right bank BR. ** 1 cylinder C1, ** 2 cylinder C2, and ** 3 cylinder C3 Operation is stopped and it is the left bank BL. ** 4-cylinder C4, ** 5-cylinder C5, and ** 6-cylinder C6 By operating Aforementioned ** 4-cylinder C4, ** 5-cylinder C5, and ** 6-cylinder C6 Partial cylinder operation to which the rate of the load to pay is made to increase can be performed, and improvement in the thermal efficiency of Engine E can be aimed at as a whole. As for the field which performs partial cylinder operation in this example, let an engine speed Ne be the field of 1000 or more rpm and 3500 rpm or less.

[0028] Next, the operation at the time of a change-over of all cylinder operation -> partial cylinder operation is explained, referring to the timing diagram of drawing 8 in drawing 6 and the flow chart of drawing 7 , and a list.

[0029] It is the engine-speed detection means S3 at step S1 first. If an engine speed Ne is detected and an engine speed Ne enters inside from from outside the field of 1000 rpm<=Ne<=3500rpm, it

will judge that the change-over conditions of all cylinder operation -> partial cylinder operation were satisfied, and a change-over command will be outputted at step S2. Then, it is the oil pressure detection means S1 at step S3. And oil-temperature detection means S2 Oil pressure POIL of the oil in which an oil pump 41 carries out the regurgitation And oil temperature TOIL It detects and is oil pressure POIL. And oil temperature TOIL It is based and map retrieval of the change-over response time A (crank angle conversion) is carried out. That is, it is oil pressure POIL about the change-over response time A which is equivalent to a time lag after solenoid valves 45i and 45e turn on until gas column pause device 11 -- operates since the standup of the oil pressure in gas column pause device 11 -- changes according to the condition of oil when solenoid valves 45i and 45e open and oil pressure is supplied to gas column pause device 11 --. And oil temperature TOIL It bases and sets up.

[0030] Then, it sets to step S4 and it is # 1 cylinder C1. It carries out the trigger given by the crank angle measured from inhalation of air TDC to the advancing side outside, Timing alpha (constant determined by the model of engine E) is read, and it sets to step S5 further, and is the engine-speed detection means S3. The detected engine speed Ne and inhalation-of-air negative pressure detection means S4 Based on the detected real inhalation-of-air negative pressure Pb, map retrieval of the delay time B (crank angle conversion) is carried out. Delay time B is inhalation-of-air negative pressure detection means S4. The timing which uses the prediction inhalation-of-air negative pressure Pb which replaced with the detected real inhalation-of-air negative pressure Pb, and was set up beforehand is specified, and the detail is explained later.

[0031] Then, nearest # 1 cylinder C1 from the output of a change-over command [in / on step S6 and / said step S2] Crank angle X to inhalation of air TDC is computed. And if it is X>A+alpha at step S7 that is, it is # 1 cylinder C1 to the beginning. If there will be time allowances longer than the change-over response time A by the time a trigger separates Determine the inhalation of air TDC of first # 1 cylinder C1 as the change-over point, and IMINGU in which only X- (A+alpha) has passed since this time (at the time of a change-over command output) in step S9 is considered as the ON/OFF point of solenoid valves 45i and 45e. Solenoid valves 45i and 45e are driven at step S10.

[0032] On the other hand, if it is X<=A+alpha at said step S7 (i.e., if time allowances until the trigger of # 1 cylinder C1 separates first are shorter than the change-over response time A), X<- X+720 degree will be repeated and performed at step S8 until it becomes X>A+alpha at step S7. And nearest # 1 cylinder C1 that becomes X>A+alpha Inhalation of air TDC is determined as the change-over point, timing to which only X- (A+alpha) has passed since this time (at the time of a change-over command output) in step S9 is considered as the ON/OFF point of solenoid valves 45i and 45e, and solenoid valves 45i and 45e are driven at step S10. consequently, the outside of a trigger -- carrying out -- the point P2 oil pressure [as opposed to / set and / the gas column pause device 11] -- rising -- the change-over point P1 from -- # 1 cylinder C1 ->#2 cylinder C2 ->#3 cylinder C3 A switch of all cylinder operation -> partial cylinder operation can be started with regularity in order.

[0033] thus, the change-over point P1 if determined -- step S11 -- the change-over point P1 only said delay time B was preceded -- having -- the substitute point P3 It sets. Inhalation-of-air negative pressure detection means S4 Until it replaces with the detected real inhalation-of-air negative pressure Pb, it makes into Sensing Pb the prediction inhalation-of-air negative pressure Pb set up beforehand and the real inhalation-of-air negative pressure Pb is in agreement with the prediction inhalation-of-air negative pressure Pb at step S13 Based on Sensing Pb (namely, prediction inhalation-of-air negative pressure Pb), control of fuel oil consumption Ti and ignition timing thetaig is performed at step S12. That is, the change-over point P1 Although fuel oil consumption Ti and ignition timing thetaig are controlled and generating of the torque shock accompanying a switch of all cylinder operation -> partial cylinder operation is avoided while setting and turning on EACV5 By controlling fuel oil consumption Ti and ignition timing thetaig not based on the real inhalation-of-air negative pressure Pb but based on the prediction inhalation-of-air negative pressure Pb set up beforehand in that case All cylinder operations -> the effect of the response delay of the real inhalation-of-air negative pressure Pb at the time of a change-over of partial cylinder operation can be eliminated, fluctuation of an air-fuel ratio can be suppressed, and generating of a torque shock can be prevented much more effectively. And if the real inhalation-of-air negative pressure Pb and the

prediction inhalation-of-air negative pressure Pb are in agreement at step S13, at step S14, it will have in the real inhalation-of-air negative pressure Pb, it will change from the prediction inhalation-of-air negative pressure Pb, again, and will return to the usual control.
[0034] drawing 10 (A) -- all -- it turns out that fluctuation of the air-fuel ratio at the time of a change-over of cylinder operation -> partial cylinder operation is not shown, and the range of fluctuation of the air-fuel ratio of the thing of this invention using the prediction inhalation-of-air negative pressure Pb is decreasing compared with the conventional thing which does not use the prediction inhalation-of-air negative pressure Pb.
[0035] drawing 9 -- partial-cylinder-operation -> -- how to take the change-over response time A and delay time B by showing the timing diagram at the time of all cylinder operation change-overs is as substantial as the 1st example -- it is the same. However, at the time of a partial-cylinder-operation -> all change-over [cylinder operation], it differs from the control at the time of all cylinder operation -> partial-cylinder-operation change-overs in that control of EACV5 is not performed.
drawing 10 (B) -- partial-cylinder-operation -> -- it turns out that fluctuation of the air-fuel ratio at the time of a change-over of all cylinder operations is not shown, and the range of fluctuation of the air-fuel ratio of the thing of this invention using the prediction inhalation-of-air negative pressure Pb is decreasing compared with the conventional thing which does not use the prediction inhalation-of-air negative pressure Pb.
[0036] Next, the 2nd example of this invention is explained based on drawing 11 - drawing 13 .
[0037] the 2nd example -- all -- a torque shock is avoided by carrying out closing motion control of the throttle valve 3 with an actuator 2 at the time of a change-over of cylinder operation -> partial cylinder operation, or a partial-cylinder-operation -> all change-over [cylinder operation]. If throttle opening thetaTH is made to increase from thetab to thetac when an engine torque is T and it switches all cylinder operation -> partial cylinder operation as shown in drawing 14 for example, a switch can be completed avoiding sudden change of an engine torque. However, even if it controls throttle opening thetaTH at the time of a change-over, an engine torque may not answer immediately from the response delay of the inhalation-of-air negative pressure Pb, and the torque shock at the time of a change-over may fully be unable to be prevented. So, in this example, at the time of a change-over, it amended to throttle opening thetaTH and a torque shock is prevented.
[0038] When the change-over conditions of all cylinder operation -> partial cylinder operation are first satisfied at step S21 in the flow chart of drawing 11 , it is the engine-speed detection means S3 at step S22. The detected engine speed Ne and inhalation-of-air negative pressure detection means S4 Based on the detected inhalation-of-air negative pressure Pb, map retrieval of the throttle opening controlled variable deltathetaTH and the throttle opening control time amount deltat is carried out. And in case the actuator 2 of a throttle valve 3 is driven, only said throttle opening controlled variable deltathetaTH makes throttle opening thetaTH increase by too much between said throttle opening control time amount deltat to the original augend of throttle opening thetaTH accompanying a switch at step S23, as shown in drawing 12 (B). Thus, by making throttle opening thetaTH increase too much to the original augend of throttle opening thetaTH accompanying a switch, the inhalation-of-air negative pressure Pb can be started promptly, and a torque shock can be avoided. It turns out that drawing 12 (A) shows the case where this invention is not controlled, and the torque shock by the delay of the standup of the inhalation-of-air negative pressure Pb has occurred.
[0039] drawing 13 -- partial-cylinder-operation -> -- by corresponding to a switch of all cylinder operations and decreasing throttle opening thetaTH too much to the original decrement of throttle opening thetaTH to the torque shock by the response delay of the inhalation-of-air negative pressure Pb having occurred in the conventional thing shown in (A) by the thing of this invention shown in (B), the response delay of the inhalation-of-air negative pressure Pb can be prevented, and a torque shock can be avoided.
[0040] As mentioned above, although the example of this invention was explained in full detail, this invention can perform design changes various in the range which does not deviate from the summary.
[0041] For example, at an example, it is inhalation-of-air negative pressure detection means S4 as an inhalation air content detection means. Although illustrated, other inhalation air content detection means, such as an intake air flow sensor, can be used.

[0042]
[Effect of the Invention] As mentioned above, since a control means controls engine power based on the prediction inhalation air content which replaced with the inhalation air content detected with the inhalation air content detection means, and was beforehand set up at the time of a change-over of all cylinder operations / partial cylinder operation according to invention indicated by claim 1, engine power can be controlled the optimal to the transient between all cylinder operations and partial cylinder operation, and generating of a torque shock can be avoided.
[0043] Moreover, according to invention indicated by claim 2, at the time of a change-over of all cylinder operations / partial cylinder operation, since throttle opening is amended so that the response delay of an inhalation air content may not arise, a control means can control engine power the optimal to the transient between all cylinder operations and partial cylinder operation, and can avoid generating of a torque shock.

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CLAIMS

[Claim(s)]
[Claim 1] The gas column pause device which switches all cylinder operations that operate all of two or more gas columns (C1 - C6), and the partial cylinder operation which stops actuation of a part of said gas column (C1 - C6) (11), In the control unit of the gas column pause engine equipped with the control means (U) which controls engine power based on the inhalation air content detected with the inhalation air content detection means (S4) said control means (U) The control unit of the gas column pause engine which replaces with the inhalation air content detected with said inhalation air content detection means (S4) at the time of a change-over of all cylinder operations / partial cylinder operation, and is characterized by controlling engine power based on the prediction inhalation air content set up beforehand.
[Claim 2] The gas column pause device which switches all cylinder operations that operate all of two or more gas columns (C1 - C6), and the partial cylinder operation which stops actuation of a part of said gas column (C1 - C6) (11), In the control unit of the gas column pause engine equipped with the control means (U) which controls throttle opening according to all cylinder operations and partial cylinder operation said control means (U) The control unit of the gas column pause engine characterized by amending throttle opening so that the response delay of an inhalation air content may not arise at the time of a change-over of all cylinder operations / partial cylinder operation.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The top view of the engine carried in the car
[Drawing 2] The top view of the cylinder head of a right bank
[Drawing 3] The important section enlarged drawing of drawing 2
[Drawing 4] The important section enlarged drawing of drawing 3
[Drawing 5] The operation explanatory view of a trigger
[Drawing 6] The 1st minute Fig. of a flow chart
[Drawing 7] The 2nd minute Fig. of a flow chart
[Drawing 8] All cylinder operations -> the timing diagram at the time of a partial-cylinder-operation change-over
[Drawing 9] Partial cylinder operation -> the timing diagram at the time of all cylinder operation change-overs
[Drawing 10] The graph which shows fluctuation of an air-fuel ratio
[Drawing 11] The flow chart of the 2nd example
[Drawing 12] All cylinder operations -> the graph which shows change of the throttle opening at the time of a partial-cylinder-operation change-over, and inhalation-of-air negative pressure
[Drawing 13] Partial cylinder operation -> the graph which shows change of the throttle opening at the time of all cylinder operation change-overs, and inhalation-of-air negative pressure
[Drawing 14] The graph which shows the throttle opening at the time of all cylinder operations and partial cylinder operation, and the relation of an engine torque
[Description of Notations]
11 Gas Column Pause Device
C1 - C6 Gas column
S4 Inhalation-of-air negative pressure detection means (inhalation air content detection means)
U Electronic control unit (control means)

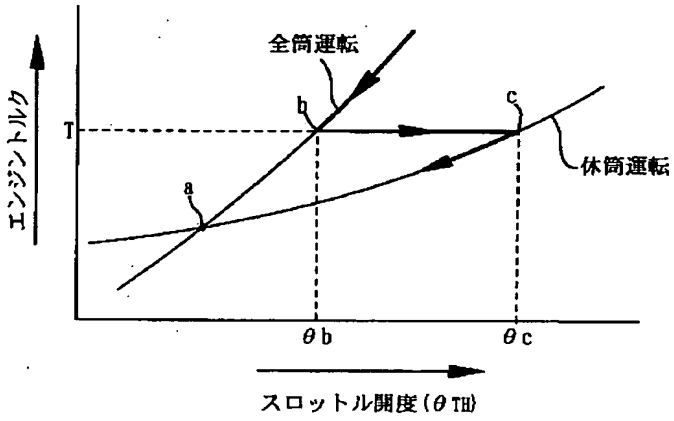
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 14]



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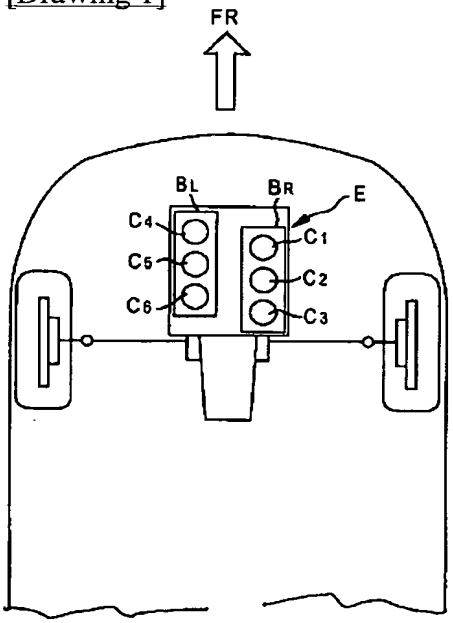

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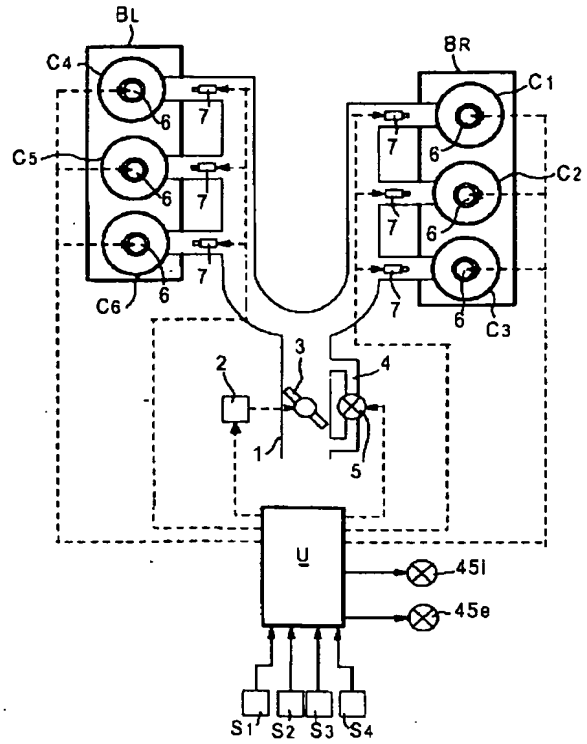

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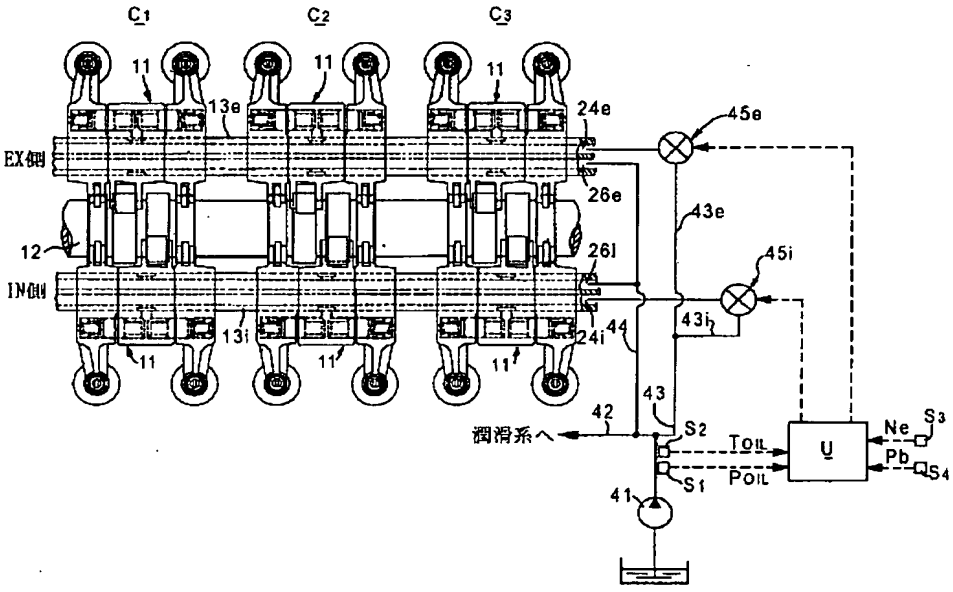

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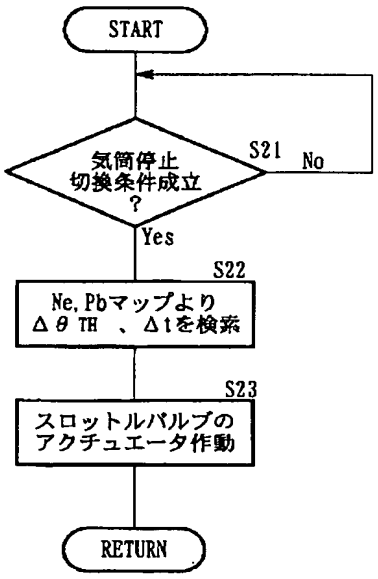

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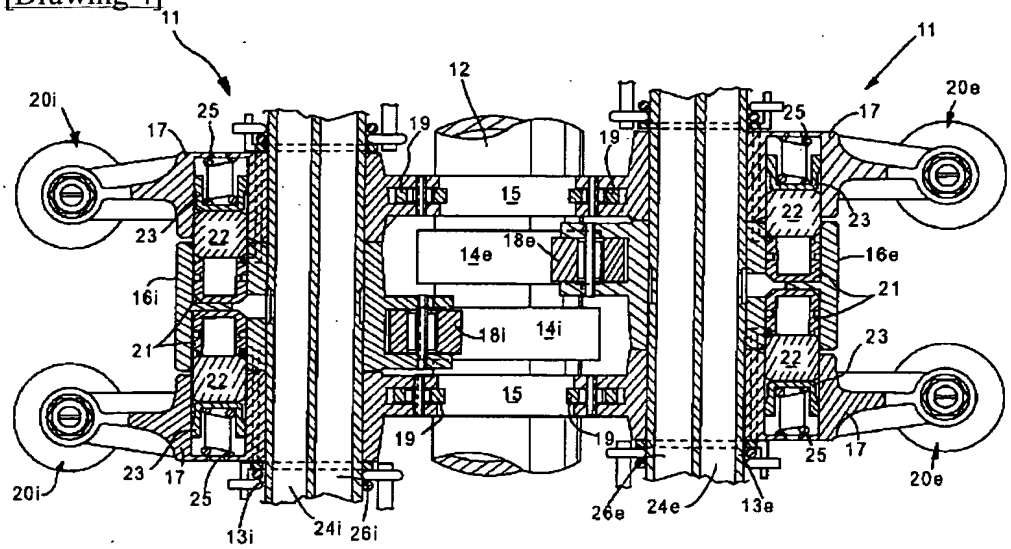

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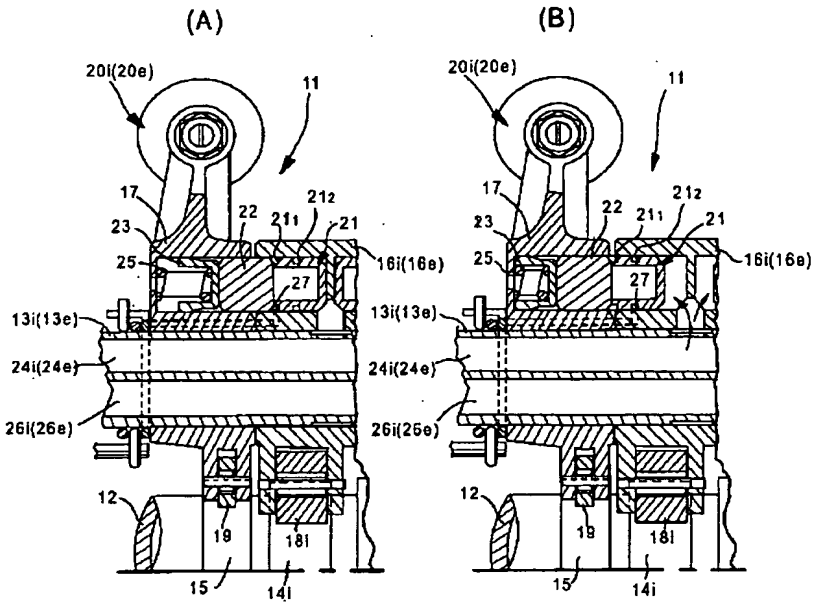

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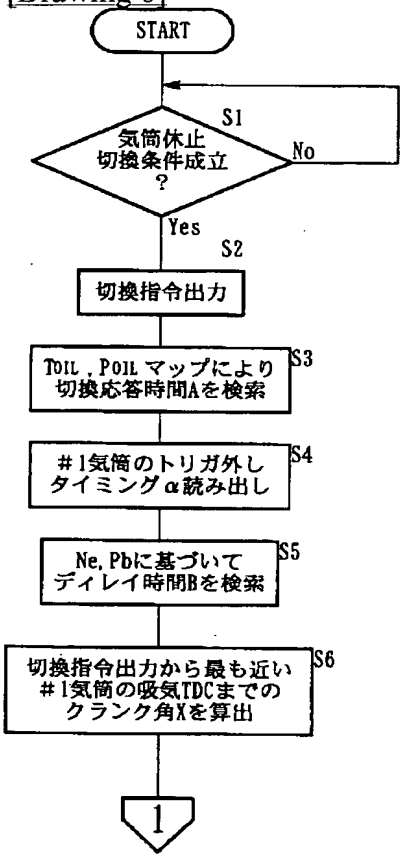

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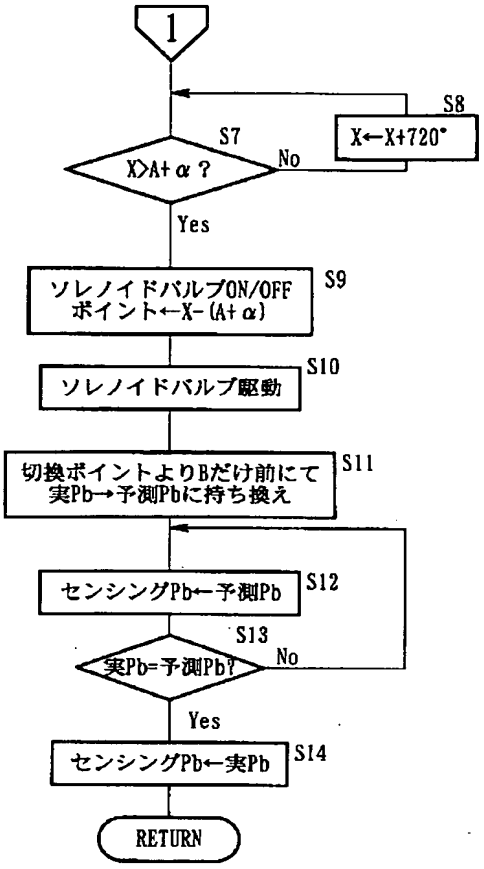

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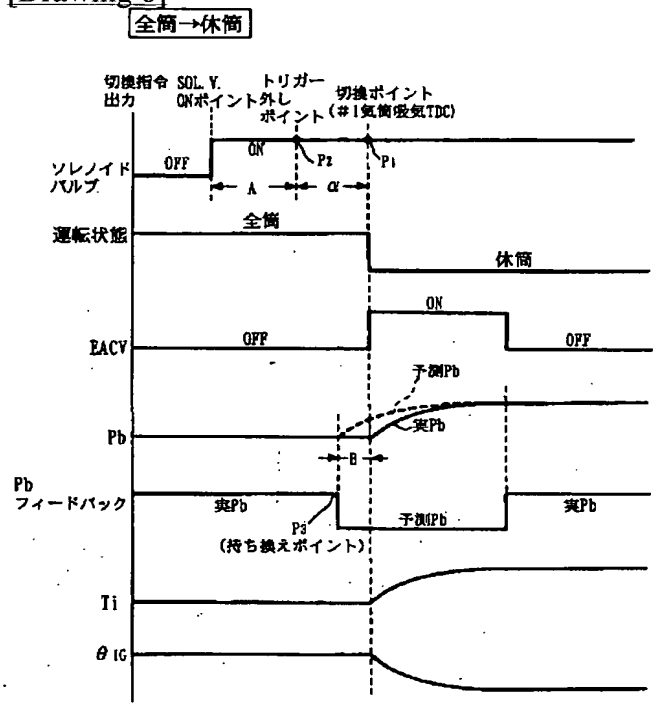

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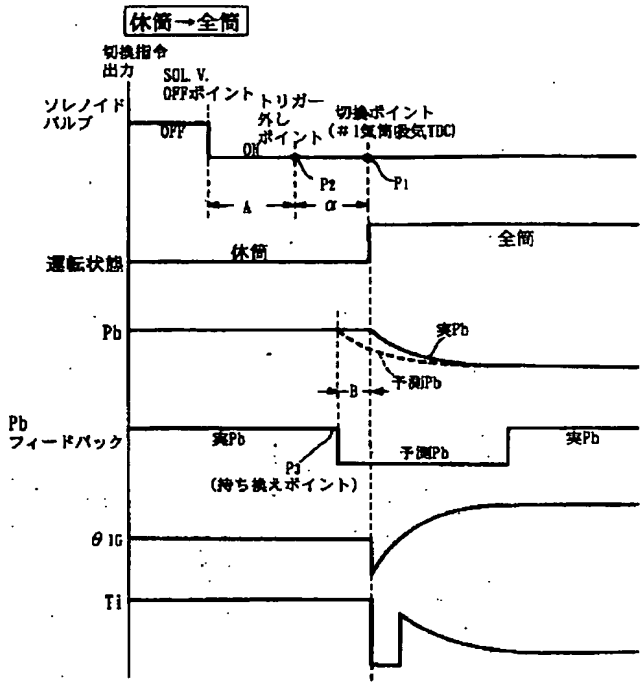

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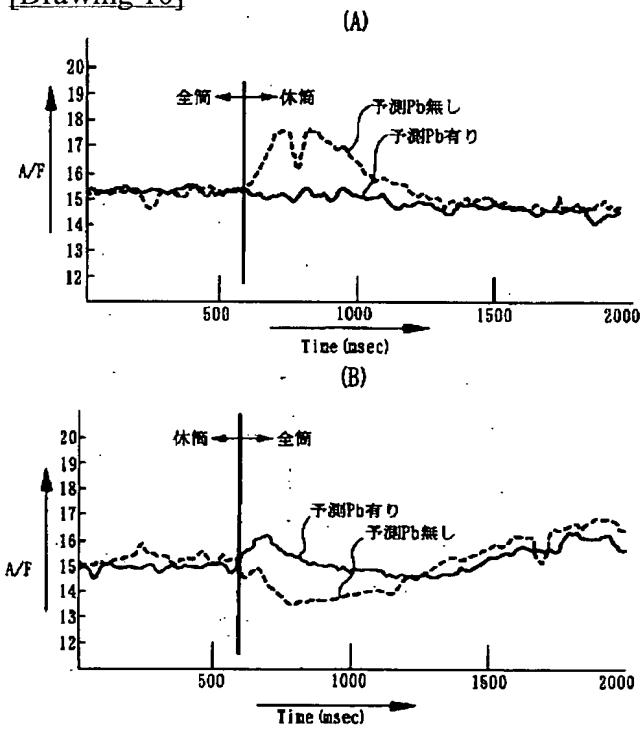

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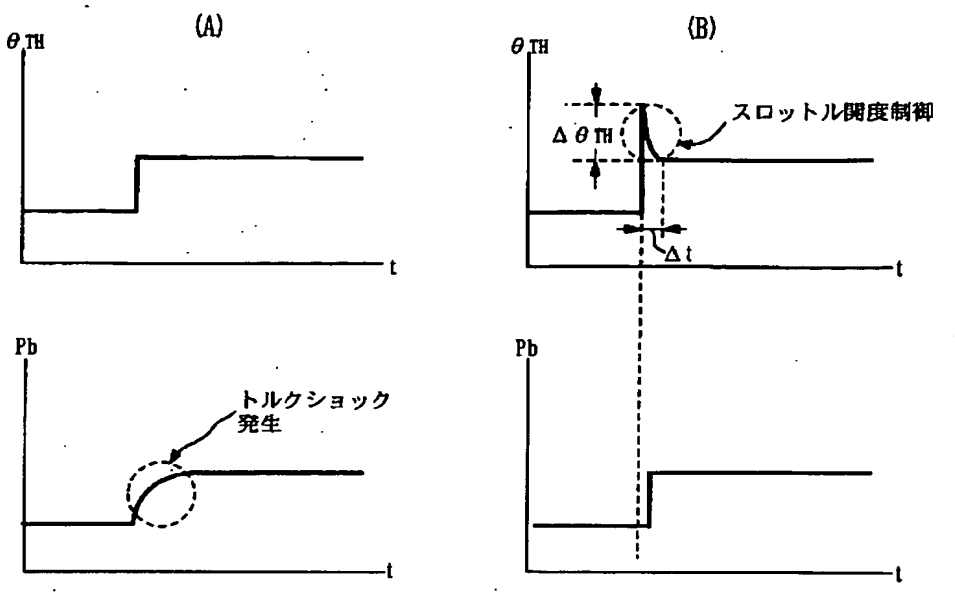

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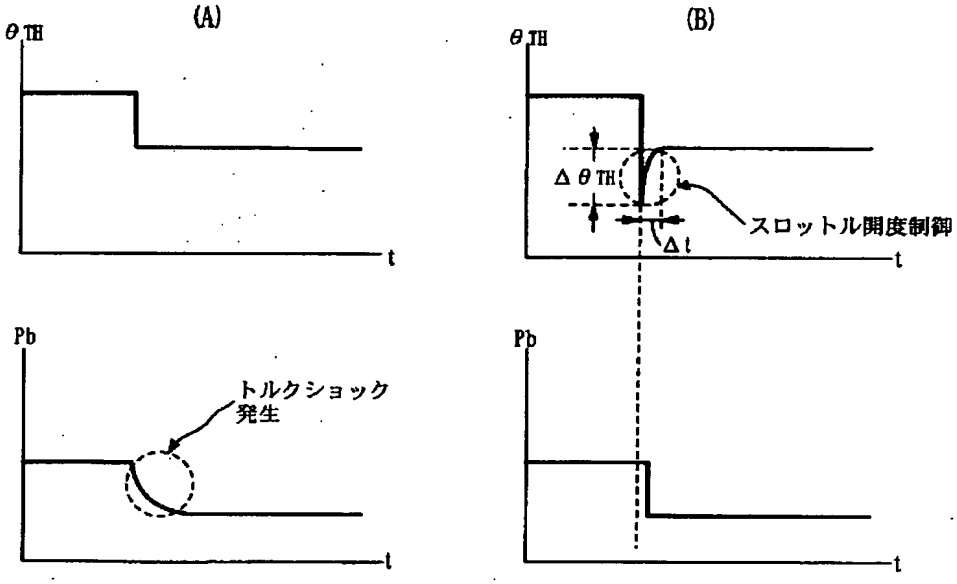

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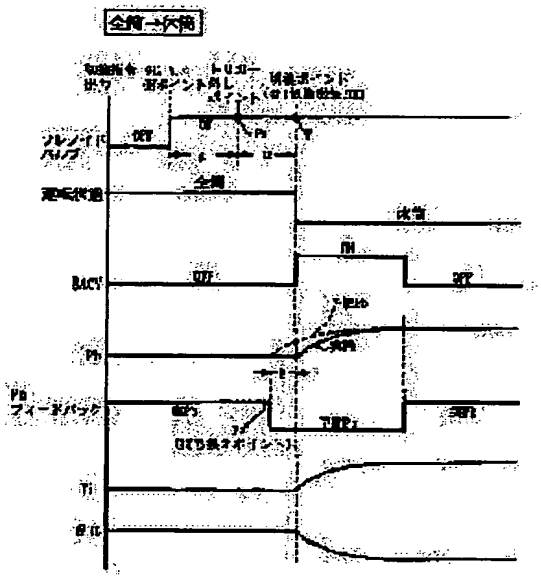
(72)Inventor : NIIKURA HIROYUKI
MORITA TERUYOSHI
YUHARA HIROMITSU

(54) CYLINDER-HALTED ENGINE CONTROLLER

(57)Abstract:
PROBLEM TO BE SOLVED: To effectively prevent torque shocks in changing over an engine between an operation on its full cylinders and an operation with its cylinders halted.
SOLUTION: In order to prevent torque shocks in changing over an engine from an operation on its full cylinders to an operation with its cylinders halted, an electronic air control valve(EACV) is opened as well as an injection quantity Ti and ignition timing θIG are controlled on the basis of an actual intake back pressure Pb detected by a detector means. Since the use of an actual intake back pressure Pb at transition in the changeover complexes proper control, an injection quantity Ti and ignition timing θIG are controlled on the basis of a predicted intake back pressure Pb stored in advance at a shifted position precedent to the changeover point by a delay period B. That shifted point is returned to the original control using an actual intake back pressure Pb when the actual intake back pressure Pb becomes equal to the predicted intake back pressure Pb after the completion of the changeover.



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[Date of final disposal for application]
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[Date of registration]

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(51)Int. Cl.[6]		識別記号	FI			
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	41/02	３１０		41/02	３１０	C
	45/00	３０１		45/00	３０１	D
Ｆ０２Ｐ	5/15		Ｆ０２Ｐ	5/15		B

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(22)出願日　平成8年(1996)9月26日

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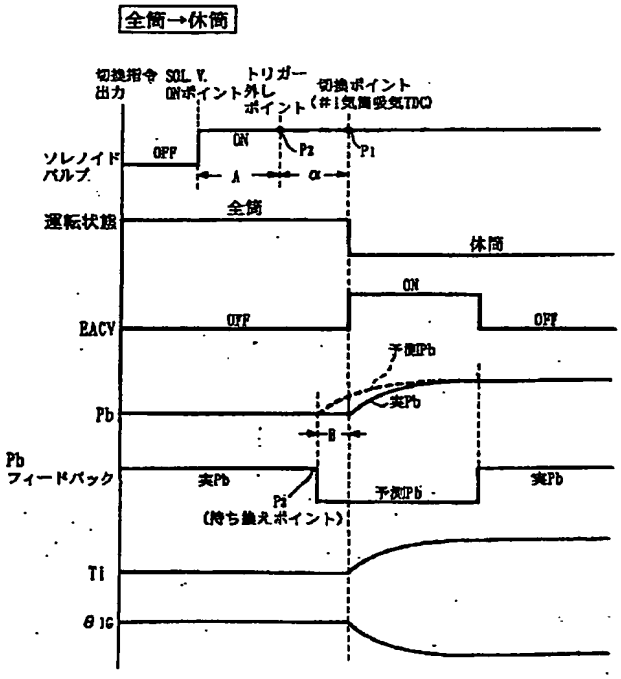
(54)【発明の名称】気筒休止エンジンの制御装置

(57)【要約】

【課題】　全筒運転／休筒運転の切り換え時におけるトルクショックの発生を効果的に防止する。

【解決手段】　全筒運転→休筒運転の切り換え時にトルクショックが発生するのを防止すべく、ＥＡＣＶを開弁制御するとともに、検出手段で検出した実吸気負圧Ｐｂに基づいて燃料噴射量Ｔｉ及び点火時期θ_{IG}を制御する。切り換え過渡期に実吸気負圧Ｐｂを用いると適切な制御が難しいため、切り換えポイントよりもディレイ時間Ｂだけ先する持ち換えポイントから、予め記憶した予測吸気負圧Ｐｂを用いて燃料噴射量Ｔｉ及び点火時期θ_{IG}の制御を行い、切り換え完了後に実吸気負圧Ｐｂが予測吸気負圧Ｐｂに一致したときに、実吸気負圧Ｐｂを用いた元の制御に復帰する。



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【特許請求の範囲】

【請求項１】　複数の気筒（C_1 ～C_6）の全部を作動させる全筒運転と前記気筒（C_1 ～C_6）の一部の作動を休止する休筒運転とを切り換える気筒休止機構（１１）と、吸入空気量検出手段（S_4）で検出した吸入空気量に基づいてエンジン出力を制御する制御手段（Ｕ）とを備えた気筒休止エンジンの制御装置において、

前記制御手段（Ｕ）は、全筒運転／休筒運転の切換時に、前記吸入空気量検出手段（S_4）で検出した吸入空気量に代えて、予め設定した予測吸入空気量に基づいてエンジン出力を制御することを特徴とする、気筒休止エンジンの制御装置。

【請求項２】　複数の気筒（C_1 ～C_6）の全部を作動させる全筒運転と前記気筒（C_1 ～C_6）の一部の作動を休止する休筒運転とを切り換える気筒休止機構（１１）と、全筒運転及び休筒運転に応じてスロットル開度を制御する制御手段（Ｕ）とを備えた気筒休止エンジンの制御装置において、

前記制御手段（Ｕ）は、全筒運転／休筒運転の切換時に、吸入空気量の応答遅れが生じないようにスロットル開度を補正することを特徴とする、気筒休止エンジンの制御装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、複数の気筒の全部を作動させる全筒運転と前記気筒の一部の作動を休止する休筒運転とを切り換える気筒休止機構を備えた気筒休止エンジンに関し、特に、全筒運転／休筒運転の切換時にトルクショックの発生を防止するための制御装置に関する。

【０００２】

【従来の技術】全筒運転／休筒運転の切換時にトルクショックの発生を防止する技術が、特公昭６３－２１８１２号公報、特開昭６２－１０３４３０号公報により公知である。

【０００３】図１４は、スロットル開度の変化に対するエンジントルクの変化を、全筒運転時及び休筒運転時について示すものである。同図から明らかなように、両ラインの交点ａでは、全筒運転及び休筒運転のスロットル開度及びエンジントルクが一致することから、前記特公昭６３－２１８１２号公報に記載されたものは、前記ａ点に対応する運転状態で全筒運転及び休筒運転を切り換えることによりトルクショックの発生を回避している。

【０００４】また前記特開昭６２－１０３４３０号公報に記載されたものは、同じアクセル開度に対して全筒運転時のエンジントルクと休筒運転時のエンジントルクとが一致するように、図１４のｂ点及びｃ点間でスロットル開度を制御することによりトルクショックの発生を回避している。

【０００５】

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【発明が解決しようとする課題】しかしながら、前記特公昭６３－２１８１２号公報に記載されたものは、全筒運転時及び休筒運転時のエンジントルクが一致する特定の運転状態でしか全筒運転／休筒運転の切り換えを行うことができない問題がある。また前記特開昭６２－１０３４３０号公報に記載されたものは、全筒運転／休筒運転の切換時にスロットル開度を制御してトルクショックの発生を回避しようとしても、スロットル開度の変化に対して吸気負圧の応答が遅れるため、トルクショックの発生を充分に回避することが難しいという問題がある。

【０００６】本発明は前述の事情に鑑みてなされたもので、全筒運転／休筒運転の切換時におけるトルクショックの発生を効果的に防止することを目的とする。

【０００７】

【課題を解決するための手段】請求項１に記載された発明では、全筒運転／休筒運転の切換時以外には、制御手段は吸入空気量検出手段で検出した吸入空気量に基づいてエンジン出力を制御する。全筒運転／休筒運転の切換時には、制御手段は前記吸入空気量検出手段で検出した吸入空気量に代えて、予め設定した予測吸入空気量に基づいてエンジン出力を制御する。これにより、全筒運転及び休筒運転間の過渡時にエンジン出力を最適に制御してトルクショックの発生を回避することができる。

【０００８】請求項２に記載された発明では、全筒運転／休筒運転の切換時以外には、制御手段は全筒運転及び休筒運転に応じてスロットル開度を制御する。全筒運転／休筒運転の切換時には、制御手段は吸入空気量の応答遅れが生じないようにスロットル開度を補正する。これにより、全筒運転及び休筒運転間の過渡時にエンジン出力を最適に制御してトルクショックの発生を回避することができる。

【０００９】

【発明の実施の形態】以下、本発明の実施の形態を、添付図面に示した本発明の実施例に基づいて説明する。

【００１０】図１～図１０は本発明の第１実施例を示すもので、図１は車両に搭載されたエンジンの平面図、図２は吸気系の概略構成図、図３は右バンクのシリンダヘッドの平面図、図４は図３の要部拡大図、図５はトリガーの作用説明図、図６はフローチャートの第１分図、図７はフローチャートの第２分図、図８は全筒運転→休筒運転切換時のタイムチャート、図９は休筒運転→全筒運転切換時のタイムチャート、図１０は空燃比の変動を示すグラフである。

【００１１】図１に示すように、自動車の車体前部に縦置きに搭載されたエンジンＥはＶ型６気筒エンジンであって、右バンクB_R に＃１気筒C_1、＃２気筒C_2、＃３気筒C_3 を備えるとともに、左バンクB_L に＃４気筒C_4、＃５気筒C_5、＃６気筒C_6 を備える。エンジンＥの低負荷時には、右バンクB_R の＃１気筒C_1、＃２気筒C_2、＃３気筒C_3 の運転を休止して左バンクB_L

の＃４気筒C_4、＃５気筒C_5、＃６気筒C_6だけを運転する休筒運転が行われ、エンジンＥの高負荷時には、＃１気筒C_1～＃６気筒C_6の全てを運転する全筒運転が行われる。

【００１２】図２に示すように、＃１気筒C_1～＃６気筒C_6に連なる吸気通路１にパルスモータよりなるアクチュエータ２で開閉駆動されるスロットルバルブ３が設けられる。スロットルバルブ３の上流側及び下流側を接続するバイパス通路４に、該スロットルバルブ３を迂回する補助空気の流量を制御するＥＡＣＶ５が設けられる。

【００１３】後述するオイルポンプ４１が吐出するオイルの油圧P_{OIL}を検出する油圧検出手段S_1からの信号と、オイルポンプ４１が吐出するオイルの油温T_{OIL}を検出する油温検出手段S_2からの信号と、エンジン回転数Ｎｅを検出するエンジン回転数検出手段S_3からの信号と、吸気負圧Ｐｂを検出する吸気負圧検出手段S_4からの信号とがマイクロコンピュータよりなる電子制御ユニットＵに入力され、電子制御ユニットＵは前記油圧P_{OIL}、油温T_{OIL}、エンジン回転数Ｎｅ及び吸気負圧Ｐｂに基づいて、ＥＡＣＶ５の開度、点火プラグ６…の点火時期、燃料噴射弁７…の燃料噴射量及び後述するソレノイドバルブ４５ｉ，４５ｅの作動を制御する。

【００１４】次に、図３及び図４に基づいて右バンクB_Rの＃１気筒C_1、＃２気筒C_2、＃３気筒C_3の動弁機構の構造を説明する。

【００１５】図３に示すように、右バンクB_Rの＃１気筒C_1、＃２気筒C_2、＃３気筒C_3にはそれぞれ気筒休止機構１１…が設けられているが、その構造は同一であるため、代表として＃１気筒C_1の気筒休止機構１１について説明する。シリンダヘッドの長手方向に沿って配置されたカムシャフト１２は、図示せぬクランクシャフトに接続されて該クランクシャフトの２分の１の回転数で駆動される。カムシャフト１２の左右両側には、吸気ロッカーシャフト１３ｉと排気ロッカーシャフト１３ｅとが平行に支持される。

【００１６】図４から明らかなように、カムシャフト１２には吸気カム１４ｉと排気カム１４ｅとが隣接して設けられており、それら吸気カム１４ｉ及び排気カム１４ｅの両側にベース円のみを有する一対の休止用カム１５，１５が設けられる。吸気ロッカーシャフト１３ｉには吸気ロッカーアーム１６ｉと、その両側に位置する一対の休止用ロッカーアーム１７，１７とが揺動自在に枢支されており、吸気ロッカーアーム１６ｉの基端に前記吸気カム１４ｉに当接可能なローラ１８ｉが設けられるとともに、休止用ロッカーアーム１７，１７の基端に休止用カム１５，１５に当接可能なローラ１９，１９が設けられる。そして一対の休止用ロッカーアーム１７，１７の先端は、＃１気筒C_1の一対の吸気弁２０ｉ，２０ｉのステムエンドに当接する。

【００１７】吸気ロッカーアーム１６ｉ及び一対の休止用ロッカーアーム１７，１７を同軸に貫通するシリンダ孔の内部に、各２個の第１ピストン２１，２１、第２ピストン２２，２２及びストッパピン２３，２３が摺動自在に支持される。第１ピストン２１，２１は吸気ロッカーアーム１６ｉのシリンダ孔の内部に背中合わせに配置され、吸気ロッカーシャフト１３ｉに内部に形成した油路２４ｉから供給される油圧によって相互に離反する方向に駆動される。第１ピストン２１，２１の外側に配置された一対の第２ピストン２２，２２は、吸気ロッカーアーム１６ｉのシリンダ孔及び休止用ロッカーアーム１７，１７のシリンダ孔に跨がる連結位置と、吸気ロッカーアーム１６ｉのシリンダ孔から休止用ロッカーアーム１７，１７のシリンダ孔に押し出された連結解除位置との間を移動可能である。第２ピストン２２，２２の更に外側に配置されて休止用ロッカーアーム１７，１７のシリンダ孔内に収納された一対のストッパピン２３，２３は、それぞれスプリング２５，２５で第２ピストン２２，２２に当接する方向に付勢される。

【００１８】排気ロッカーアーム１６ｅ及び一対の休止用ロッカーアーム１７，１７を同軸に貫通するシリンダ孔の内部に、各２個の第１ピストン２１，２１、第２ピストン２２，２２及びストッパピン２３，２３が摺動自在に支持される。第１ピストン２１，２１は排気ロッカーアーム１６ｅのシリンダ孔の内部に背中合わせに配置され、排気ロッカーシャフト１３ｅに内部に形成した油路２４ｅから供給される油圧によって相互に離反する方向に駆動される。第１ピストン２１，２１の外側に配置された一対の第２ピストン２２，２２は、排気ロッカーアーム１６ｅのシリンダ孔及び休止用ロッカーアーム１７，１７のシリンダ孔に跨がる連結位置と、吸気ロッカーアーム１６ｉのシリンダ孔から休止用ロッカーアーム１７，１７のシリンダ孔に押し出された連結解除位置との間を移動可能である。第２ピストン２２，２２の更に外側に配置されて休止用ロッカーアーム１７，１７のシリンダ孔内に収納された一対のストッパピン２３，２３は、それぞれスプリング２５，２５で第２ピストン２２，２２に当接する方向に付勢される。

【００１９】吸気ロッカーアーム１６ｉ及び排気ロッカーアーム１６ｅを休止用ロッカーアーム１７に結合或いは結合解除する第２ピストン２２の移動は、吸気ロッカーアーム１６ｉ及び排気ロッカーアーム１６ｅの揺動に連動して進退するトリガー２７によって規制される。即ち、第２ピストン２２が図５（Ａ）に示す連結位置にあるとき、トリガー２７は第１ピストン２１の第１係止溝21_1に係合して該第１ピストン２１の移動を規制しており、従って第２ピストン２２も前記連結位置に固定される。吸気ロッカーアーム１６ｉ及び排気ロッカーアーム１６ｅの開弁方向へのリフト（吸気弁２０ｉ及び排気弁２０ｅを開弁する方向への揺動）がトリガー外れリフ

トに達すると、トリガー２７が矢印方向に後退して第１ピストン２１…の第１係止溝２１$_1$ から離脱し、第１ピストン２１…は移動可能な状態になる。また、第２ピストン２２が図５（Ｂ）に示す連結解除位置にあるとき、トリガー２７は第１ピストン２１の第２係止溝２１$_2$ に係合して該第１ピストン２１の移動を規制しており、従って第２ピストン２２も前記連結解除位置に固定される。吸気ロッカーアーム１６ｉ及び排気ロッカーアーム１６ｅの開弁方向へのリフトがトリガー外れリフトに達すると、トリガー２７が矢印方向に後退して第１ピストン２１…の第２係止溝２１$_2$ から離脱し、第１ピストン２１…は移動可能な状態になる。

【００２０】尚、図３において、吸気ロッカーシャフト１３ｉ及び排気ロッカーシャフト１３ｅ内に設けられた油路２６ｉ，２６ｅは、油圧タペットに給油する油路である。

【００２１】上記構成により、吸気ロッカーシャフト１３ｉの油路２４ｉに油圧が供給されていないとき、スプリング２５，２５の弾発力で付勢された一対の第２ピストン２２，２２は図５（Ａ）に示した連結位置にあり、吸気ロッカーアーム１６ｉを一対の休止用ロッカーアーム１７，１７に一体に結合している。従って、カムシャフト１２に設けた吸気カム１４ｉにローラ１８ｉを当接させた吸気ロッカーアーム１６ｉが吸気ロッカーシャフト１３ｉ回りに揺動すると、それと一体に結合された一対の休止用ロッカーアーム１７，１７が揺動して吸気弁２０ｉ，２０ｉを開閉駆動する。吸気弁２０ｉ，２０ｉがリフトするとき、休止用ロッカーアーム１７，１７のローラ１９，１９は、ベース円よりなる休止用カム１５，１５から離反する。

【００２２】吸気ロッカーシャフト１３ｉの油路２４ｉに油圧を供給すると、吸気ロッカーアーム１６ｉがトリガー外れリフトまで揺動したときに、トリガー２７，２７が第１係止溝２１$_1$，２１$_1$ から外れて第１ピストン２１，２１、第２ピストン２２，２２及びストッパピン２３，２３がスプリング２５，２５に抗して図５（Ｂ）の位置に移動し、第２ピストン２２，２２が連結解除位置に達して吸気ロッカーアーム１６ｉと休止用ロッカーアーム１７，１７との連結が解除される。その結果、吸気ロッカーアーム１６ｉの揺動は休止用ロッカーアーム１７，１７に伝達されなくなり、ベース円のみを備えた休止用カム１５，１５にローラ１９，１９を当接させた休止用ロッカーアーム１７，１７は揺動を停止し、吸気弁２０ｉ，２０ｉは閉弁状態に保持される。

【００２３】吸気ロッカーシャフト１３ｉの油路２４ｉから油圧を抜くと、吸気ロッカーアーム１６ｉがトリガー外れリフトまで揺動したときに、トリガー２７，２７が第２係止溝２１$_2$，２１$_2$ から外れて第１ピストン２１，２１、第２ピストン２２，２２及びストッパピン２３，２３がスプリング２５，２５の弾発力で図５（Ａ）

の位置に移動し、第２ピストン２２，２２が連結位置に達して吸気ロッカーアーム１６ｉと休止用ロッカーアーム１７，１７とが連結される。その結果、吸気ロッカーアーム１６ｉの揺動が休止用ロッカーアーム１７，１７に伝達されるようになり、吸気ロッカーアーム１６ｉの揺動に伴って吸気弁２０ｉ，２０ｉは再び開閉駆動される。

【００２４】以上、吸気弁２０ｉ，２０ｉの作動について説明したが、排気弁２０ｅ，２０ｅの作動も実質的に同一であるため、その重複する説明は省略する。

【００２５】図３から明らかなように、エンジンＥにより駆動されるオイルポンプ４１は、エンジンＥ各部の潤滑系に連なる油路４２と、気筒休止機構１１…の油路２４ｉ，２４ｅに連なる油路４３と、油圧タペットの油路２６ｉ，２６ｅに連なる油路４４とに給油する。オイルポンプ４１から延びる油路４３から二股に分岐して吸気ロッカーシャフト１３ｉの油路２４ｉ及び排気ロッカーシャフト１３ｅの油路２４ｅに連なる油路４３ｉ、４３ｅに、それぞれソレノイドバルブ４５ｉ，４５ｅが設けられる。ソレノイドバルブ４５ｉ，４５ｅは常閉弁よりなり、ソレノイドを励磁すると開弁して気筒休止機構１１…が作動し、＃１気筒Ｃ$_1$ ～＃３気筒Ｃ$_3$ の作動を休止することができる。

【００２６】次に、前述の構成を備えた本発明の実施例の作用について説明する。

【００２７】エンジンＥは高負荷時の方が低負荷時よりも熱効率が高い運転が可能であるため、高負荷時には左右のバンクＢ$_L$，Ｂ$_R$ の＃１気筒Ｃ$_1$ ～＃６気筒Ｃ$_6$ の全てを運転する全筒運転を行い、低負荷時には右バンクＢ$_R$ の＃１気筒Ｃ$_1$ 、＃２気筒Ｃ$_2$ 、＃３気筒Ｃ$_3$ の運転を休止して左バンクＢ$_L$ の＃４気筒Ｃ$_4$ 、＃５気筒Ｃ$_5$ 、＃６気筒Ｃ$_6$ だけを運転することにより、前記＃４気筒Ｃ$_4$ 、＃５気筒Ｃ$_5$ 、＃６気筒Ｃ$_6$ が負担する負荷の割合を増加させる休筒運転を行い、全体としてエンジンＥの熱効率の向上を図ることができる。本実施例において休筒運転を行う領域は、エンジン回転数Ｎｅが１０００ｒｐｍ以上、３５００ｒｐｍ以下の領域とされる。

【００２８】次に、図６及び図７のフローチャート、並びに図８のタイムチャートを参照しながら、全筒運転→休筒運転の切換時の作用を説明する。

【００２９】先ずステップＳ１でエンジン回転数検出手段Ｓ$_3$ によりエンジン回転数Ｎｅを検出し、エンジン回転数Ｎｅが１０００ｒｐｍ≦Ｎｅ≦３５００ｒｐｍの領域の外から内に入れば全筒運転→休筒運転の切換条件が成立したと判断し、ステップＳ２で切換指令を出力する。続いて、ステップＳ３で油圧検出手段Ｓ$_1$ 及び油温検出手段Ｓ$_2$ によりオイルポンプ４１が吐出するオイルの油圧Ｐ$_{OIL}$ 及び油温Ｔ$_{OIL}$ を検出し、油圧Ｐ$_{OIL}$ 及び油温Ｔ$_{OIL}$ に基づいて切換応答時間Ａ（クランク角換算）をマップ検索する。即ち、ソレノイドバルブ４５

ｉ，４５ｅが開弁して気筒休止機構１１…に油圧が供給されたとき、気筒休止機構１１…における油圧の立ち上がりがオイルの状態に応じて変化するため、ソレノイドバルブ４５ｉ，４５ｅがＯＮしてから気筒休止機構１１…が作動するまでの時間遅れに相当する切換応答時間Ａを油圧P_{OIL}及び油温T_{OIL}に基づいて設定する。

【００３０】続いて、ステップＳ４において、＃１気筒C_1の吸気ＴＤＣから進み側に測ったクランク角で与えられるトリガ外しタイミングα（エンジンＥの機種により決められた定数）を読み出し、更にステップＳ５において、エンジン回転数検出手段S_3で検出したエンジン回転数Ｎｅと、吸気負圧検出手段S_4で検出した実吸気負圧Ｐｂとに基づいてディレイ時間Ｂ（クランク角換算）をマップ検索する。ディレイ時間Ｂは、吸気負圧検出手段S_4で検出した実吸気負圧Ｐｂに代えて予め設定した予測吸気負圧Ｐｂを使用するタイミングを規定するものであり、その詳細は後から説明する。

【００３１】続いて、ステップＳ６において、前記ステップＳ２における切換指令の出力から最も近い＃１気筒C_1の吸気ＴＤＣまでのクランク角Ｘを算出する。そして、ステップＳ７でＸ＞Ａ＋αであれば、つまり、最初に＃１気筒C_1のトリガが外れるまでに切換応答時間Ａよりも長い時間的余裕があれば、最初の＃１気筒C_1の吸気ＴＤＣを切換ポイントと決定し、ステップＳ９で現時点（切換指令出力時）からＸ－（Ａ＋α）だけ経過したイミングをソレノイドバルブ４５ｉ，４５ｅのＯＮ／ＯＦＦポイントとし、ステップＳ１０でソレノイドバルブ４５ｉ，４５ｅを駆動する。

【００３２】一方、前記ステップＳ７でＸ≦Ａ＋αであれば、つまり、最初に＃１気筒C_1のトリガが外れるまでの時間的余裕が切換応答時間Ａよりも短ければ、ステップＳ７でＸ＞Ａ＋αになるまで、ステップＳ８でＸ←Ｘ＋７２０°を繰り返し実行する。そしてＸ＞Ａ＋αになる最も近い＃１気筒C_1の吸気ＴＤＣを切換ポイントと決定し、ステップＳ９で現時点（切換指令出力時）からＸ－（Ａ＋α）だけ経過したタイミングをソレノイドバルブ４５ｉ，４５ｅのＯＮ／ＯＦＦポイントとし、ステップＳ１０でソレノイドバルブ４５ｉ，４５ｅを駆動する。その結果、トリガー外しポイントP_2において気筒休止機構１１に対する油圧を立ち上げ、切換ポイントP_1から＃１気筒C_1→＃２気筒C_2→＃３気筒C_3の順に規則性を持って全筒運転→休筒運転の切り換えを開始することができる。

【００３３】このようにして、切換ポイントP_1が決定されると、ステップＳ１１で切換ポイントP_1よりも前記ディレイ時間Ｂだけ先行した持ち換えポイントP_3において、吸気負圧検出手段S_4で検出した実吸気負圧Ｐｂに代えて、予め設定された予測吸気負圧Ｐｂをセンシング Ｐｂとし、ステップＳ１３で実吸気負圧Ｐｂが予測吸気負圧Ｐｂに一致するまで、ステップＳ１２でセンシングＰｂ（即ち、予測吸気負圧Ｐｂ）に基づいて燃料噴射量Ｔｉ及び点火時期θ_{ig}の制御を行う。つまり、切換ポイントP_1において、ＥＡＣＶ５をＯＮするとともに燃料噴射量Ｔｉ及び点火時期θ_{ig}を制御して全筒運転→休筒運転の切り換えに伴うトルクショックの発生を回避するが、その際に実吸気負圧Ｐｂではなく、予め設定された予測吸気負圧Ｐｂに基づいて燃料噴射量Ｔｉ及び点火時期θ_{ig}を制御することにより、全筒運転→休筒運転の切換時における実吸気負圧Ｐｂの応答遅れの影響を排除し、空燃比の変動を抑えてトルクショックの発生を一層効果的に防止することができる。そしてステップＳ１３で実吸気負圧Ｐｂと予測吸気負圧Ｐｂとが一致すると、ステップＳ１４で再び予測吸気負圧Ｐｂから実吸気負圧Ｐｂに持ち換えて通常の制御に復帰する。

【００３４】図１０（Ａ）は全筒運転→休筒運転の切換時における空燃比の変動を示すもので、予測吸気負圧Ｐｂを用いない従来のものに比べて、予測吸気負圧Ｐｂを用いた本発明のものの空燃比の変動幅が減少していることが分かる。

【００３５】図９には休筒運転→全筒運転切換時のタイムチャートが示されており、切換応答時間Ａ及びディレイ時間Ｂの取り方は第１実施例と実質的の同一である。但し、休筒運転→全筒運転切換時にはＥＡＣＶ５の制御が行われない点で、全筒運転→休筒運転切換時の制御と異なっている。図１０（Ｂ）は休筒運転→全筒運転の切換時における空燃比の変動を示すもので、予測吸気負圧Ｐｂを用いない従来のものに比べて、予測吸気負圧Ｐｂを用いた本発明のものの空燃比の変動幅が減少していることが分かる。

【００３６】次に、図１１～図１３に基づいて本発明の第２実施例を説明する。

【００３７】第２実施例は全筒運転→休筒運転の切換時、或いは休筒運転→全筒運転切換時に、アクチュエータ２でスロットルバルブ３を開閉制御することによりトルクショックを回避するものである。図１４に示すように、例えばエンジントルクがＴであるときに全筒運転→休筒運転の切り換えを行う場合、スロットル開度θ_{TH}をθｂからθｃに増加させれば、エンジントルクの急変を回避しながら切り換えを完了することができる。しかしながら、切換時にスロットル開度θ_{TH}を制御しても、吸気負圧Ｐｂの応答遅れからエンジントルクが即座に応答せず、切換時のトルクショックを充分に防止できない場合がある。そこで本実施例では、切換時にスロットル開度θ_{TH}に補正を施してトルクショックを防止している。

【００３８】図１１のフローチャートにおいて、先ずステップＳ２１で全筒運転→休筒運転の切換条件が成立すると、ステップＳ２２でエンジン回転数検出手段S_3で検出したエンジン回転数Ｎｅと、吸気負圧検出手段S_4で検出した吸気負圧Ｐｂとに基づいて、スロットル開度制御量$\Delta\theta_{TH}$及びスロットル開度制御時間Ｔｔをマップ

検索する。そしてステップＳ２３で、スロットルバルブ３のアクチュエータ２を駆動する際に、図１２（Ｂ）に示すように、切り換えに伴うスロットル開度θ_{TH}の本来の増加量に対して、前記スロットル開度制御時間Δｔの間、前記スロットル開度制御量Δθ_{TH}だけスロットル開度θ_{TH}を余分に増加させる。このように切り換えに伴うスロットル開度θ_{TH}の本来の増加量に対してスロットル開度θ_{TH}を余分に増加させることにより、吸気負圧Ｐｂを速やかに立ち上げてトルクショックを回避することができる。図１２（Ａ）は本発明の制御を行わない場合を示すもので、吸気負圧Ｐｂの立ち上がりの遅れによるトルクショックが発生していることが分かる。

【００３９】図１３は休筒運転→全筒運転の切り換えに対応するもので、（Ａ）に示す従来のものでは吸気負圧Ｐｂの応答遅れによるトルクショックが発生しているのに対し、（Ｂ）に示す本発明のものではスロットル開度θ_{TH}の本来の減少量に対してスロットル開度θ_{TH}を余分に減少させることにより、吸気負圧Ｐｂの応答遅れを防止してトルクショックを回避することができる。

【００４０】以上、本発明の実施例を詳述したが、本発明はその要旨を逸脱しない範囲で種々の設計変更を行うことが可能である。

【００４１】例えば、実施例では吸入空気量検出手段として吸気負圧検出手段S_4を例示したが、エアフローセンサ等の他の吸入空気量検出手段を用いることができる。

【００４２】

【発明の効果】以上のように、請求項１に記載された発明によれば、制御手段が、全筒運転／休筒運転の切換時に、吸入空気量検出手段で検出した吸入空気量に代えて、予め設定した予測吸入空気量に基づいてエンジン出力を制御するので、全筒運転及び休筒運転間の過渡時にエンジン出力を最適に制御してトルクショックの発生を回避することができる。

【００４３】また請求項２に記載された発明によれば、制御手段は、全筒運転／休筒運転の切換時に、吸入空気量の応答遅れが生じないようにスロットル開度を補正するので、全筒運転及び休筒運転間の過渡時にエンジン出力を最適に制御してトルクショックの発生を回避することができる。

【図面の簡単な説明】

【図１】車両に搭載されたエンジンの平面図

【図２】右バンクのシリンダヘッドの平面図

【図３】図２の要部拡大図

【図４】図３の要部拡大図

【図５】トリガーの作用説明図

【図６】フローチャートの第１分図

【図７】フローチャートの第２分図

【図８】全筒運転→休筒運転切換時のタイムチャート

【図９】休筒運転→全筒運転切換時のタイムチャート

【図１０】空燃比の変動を示すグラフ

【図１１】第２実施例のフローチャート

【図１２】全筒運転→休筒運転切換時のスロットル開度及び吸気負圧の変化を示すグラフ

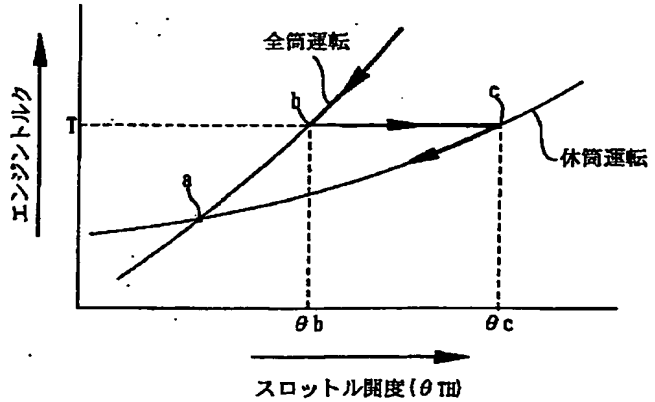
【図１３】休筒運転→全筒運転切換時のスロットル開度及び吸気負圧の変化を示すグラフ

【図１４】全筒運転時及び休筒運転時におけるスロットル開度及びエンジントルクの関係を示すグラフ

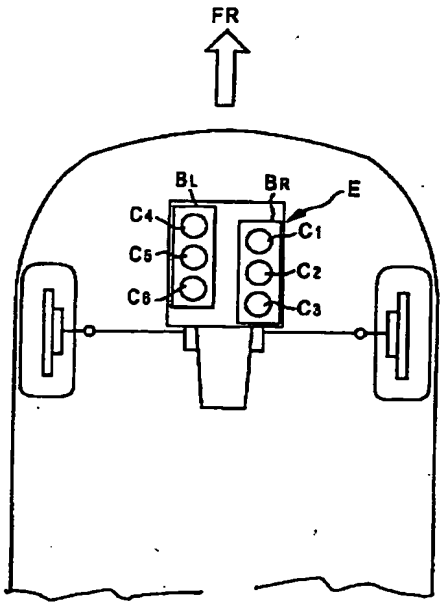
【符号の説明】

１１	気筒休止機構
C_1～C_6	気筒
S_4	吸気負圧検出手段（吸入空気量検出手段）
Ｕ	電子制御ユニット（制御手段）

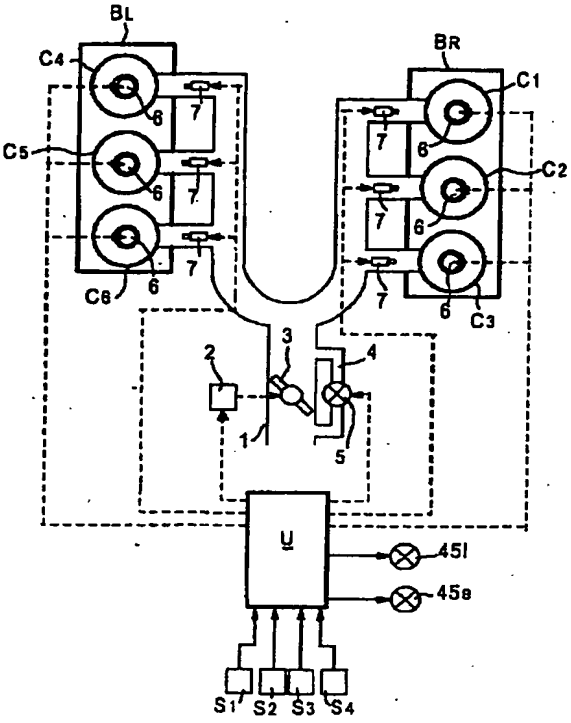
【図１４】



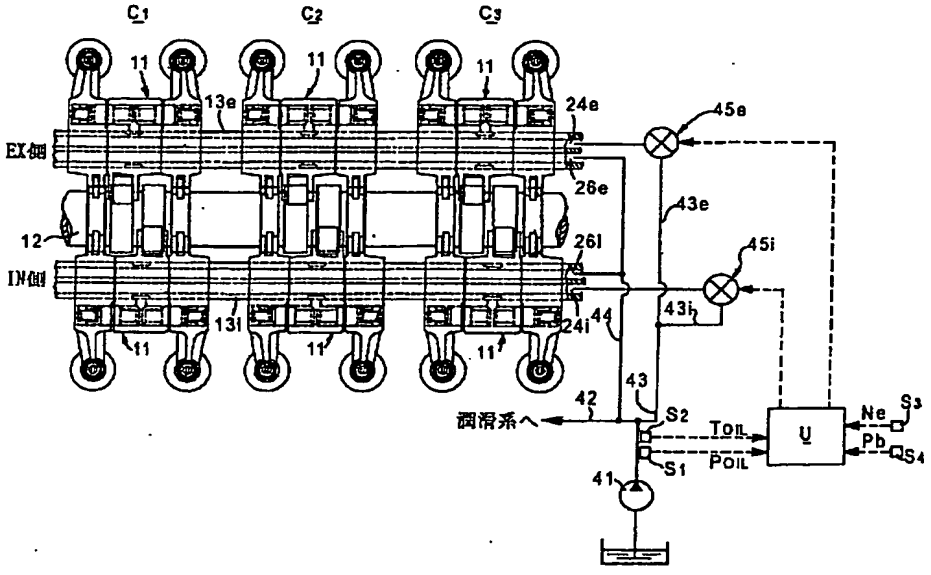
【図１】


FR
BL
BR
E
C4
C5
C6
C1
C2
C3

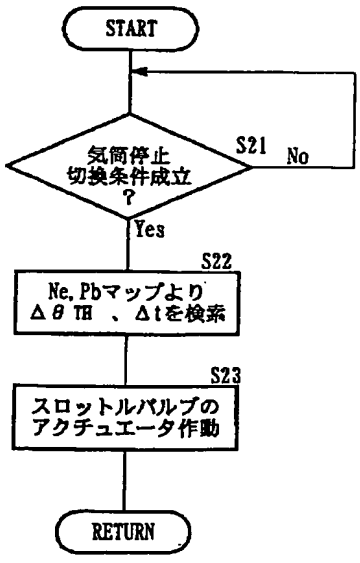
【図２】


BL
BR
C4
C5
C6
C1
C2
C3
6
7
1
2
3
4
5
U
45i
45e
S1
S2
S3
S4

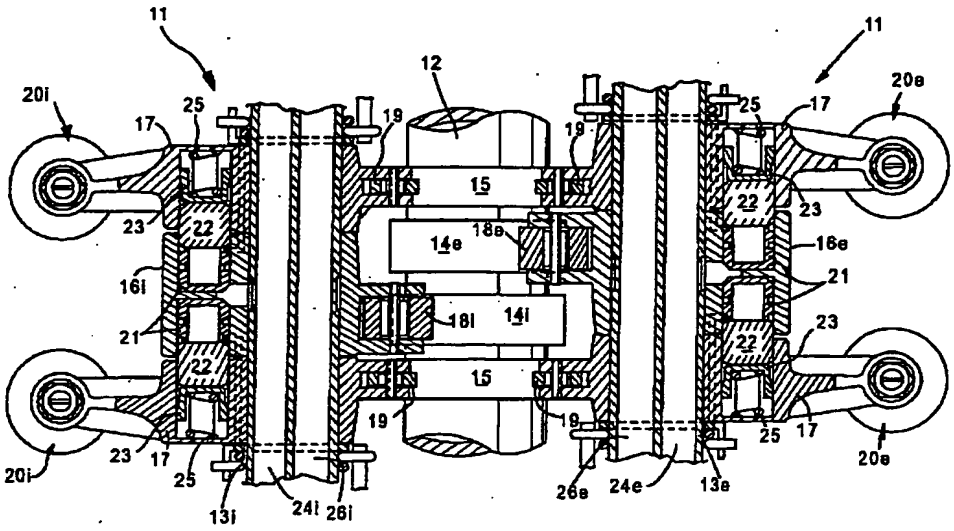
【図３】


C1
C2
C3
11
13e
13i
24e
26e
26i
24i
45e
45i
43e
43i
44
42
43
41
EX側
IN側
12
潤滑系へ
S2
S1
TOIL
POIL
U
Ne
Pb
S3
S4

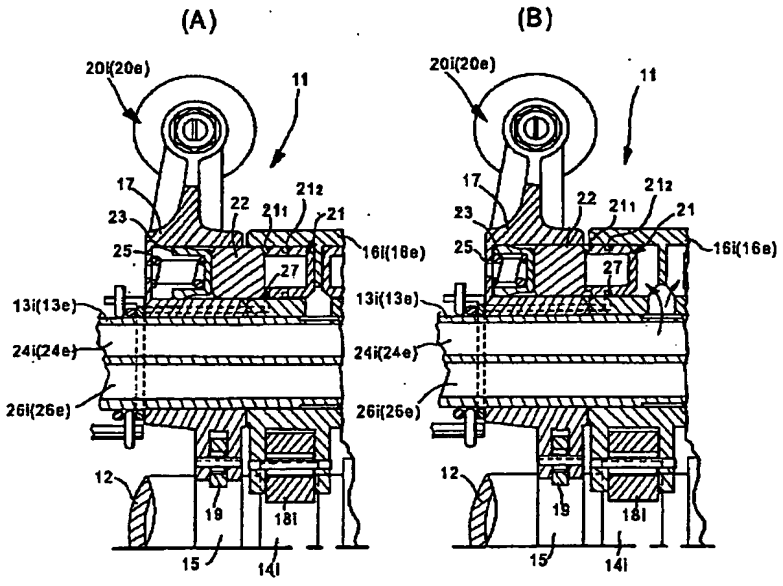
【図１１】


START
気筒停止
切換条件成立
?
S21
No
Yes
S22
Ne, Pbマップより
ΔθTH 、Δtを検索
S23
スロットルバルブの
アクチュエータ作動
RETURN

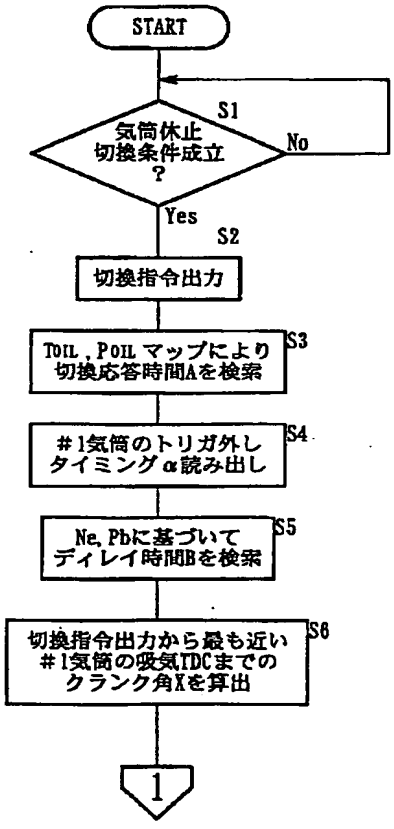
【図４】


11
12
11
20i
17
25
19
19
25
17
20e
15
22
23
18e
14e
16e
21
16i
18i
14i
21
23
22
22
15
19
19
25
17
20e
23
17
25
20i
13i
24i
26i
26e
24e
13e

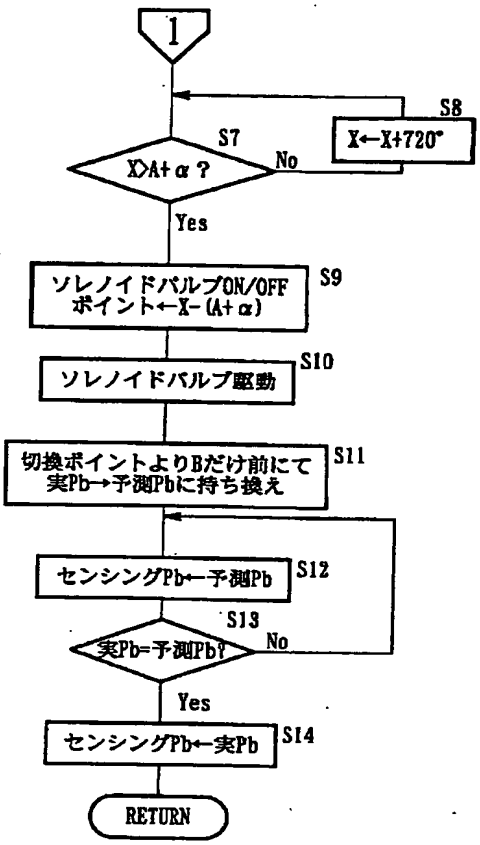
【図５】


(A)
(B)
20i(20e)
11
17
23
25
22
21₁
21₂
21
16i(18e)
27
13i(13e)
24i(24e)
26i(26e)
12
19
18i
15
14i

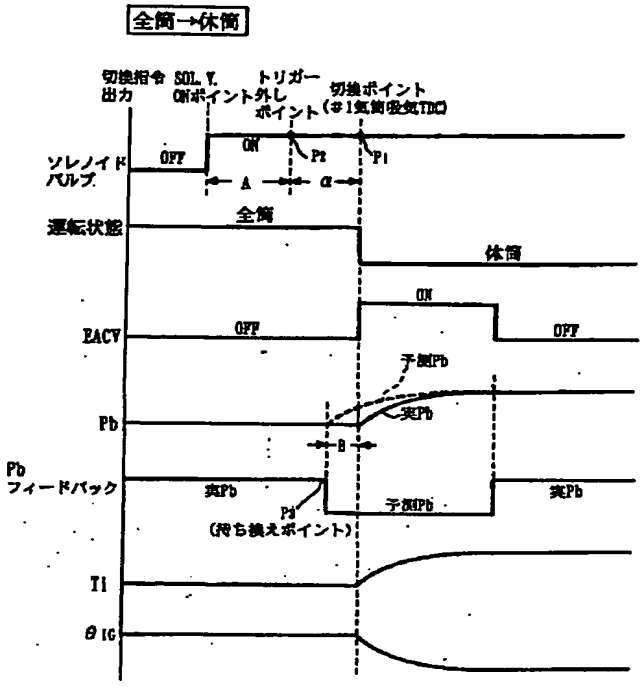
【図６】


START
S1
気筒休止
切換条件成立
?
No
Yes
S2
切換指令出力
TOIL, POIL マップにより
切換応答時間Aを検索
S3
#1気筒のトリガ外し
タイミングα読み出し
S4
Ne, Pbに基づいて
ディレイ時間Bを検索
S5
切換指令出力から最も近い
#1気筒の吸気TDCまでの
クランク角Xを算出
S6
1

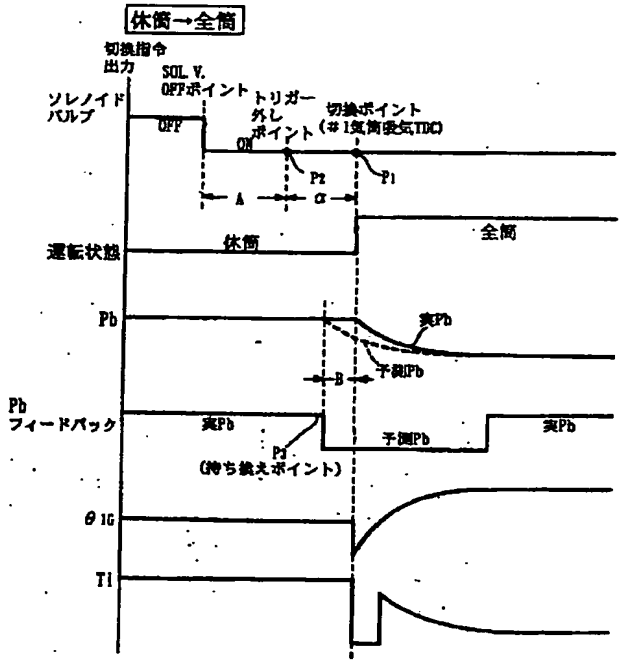
【図７】


1
S8
X←X+720°
S7
X>A+α？
No
Yes
ソレノイドバルブON/OFFポイント←X−(A+α)
S9
ソレノイドバルブ駆動
S10
切換ポイントよりBだけ前にて実Pb→予測Pbに持ち換え
S11
センシングPb←予測Pb
S12
S13
実Pb=予測Pb？
No
Yes
センシングPb←実Pb
S14
RETURN

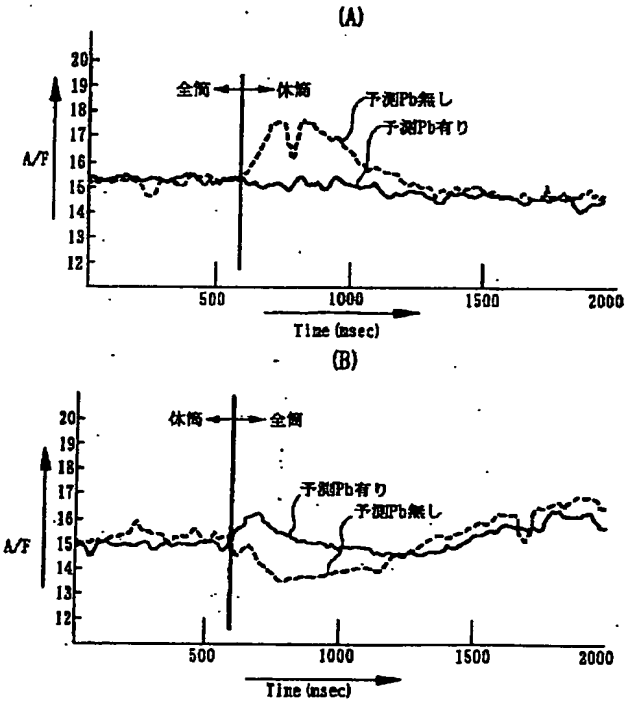
【図８】


全筒→休筒
切換指令出力
SOL.V. ONポイント
トリガー外しポイント
切換ポイント(#1気筒吸気TDC)
ソレノイドバルブ
OFF
ON
Pz
Pi
A
α
運転状態
全筒
休筒
EACV
OFF
ON
OFF
予測Pb
実Pb
Pb
B
Pb フィードバック
実Pb
Pj
(持ち換えポイント)
予測Pb
実Pb
TI
θ IG

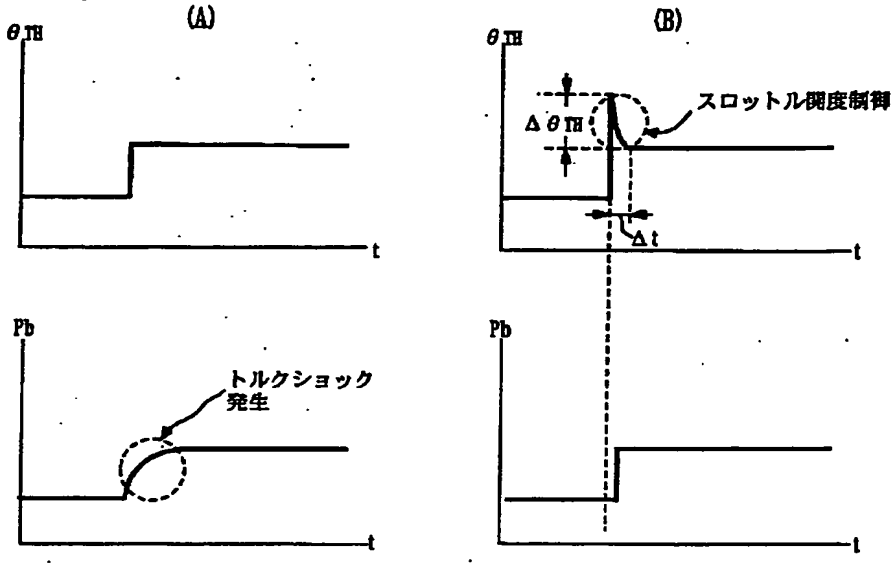
【図９】


休筒→全筒
切換指令出力
SOL.V. OFFポイント
トリガー外しポイント
切換ポイント(#1気筒吸気TDC)
ソレノイドバルブ
OFF
ON
Pz
Pi
A
α
運転状態
休筒
全筒
Pb
実Pb
B
予測Pb
Pb フィードバック
実Pb
Pj
(持ち換えポイント)
予測Pb
実Pb
θ IG
TI

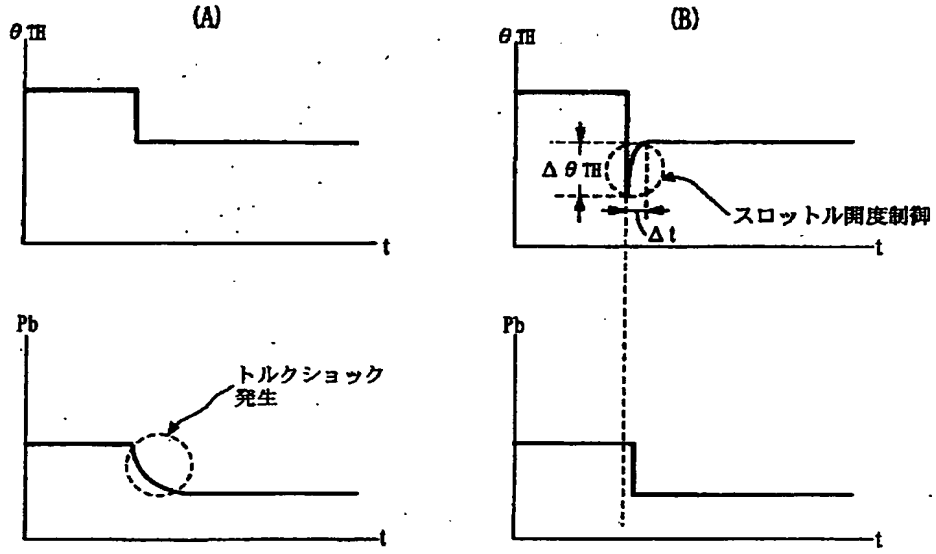
【図１０】


(A)
A/F
全筒
休筒
予測Pb無し
予測Pb有り
Time (msec)
(B)
A/F
休筒
全筒
予測Pb有り
予測Pb無し
Time (msec)

【図１２】


(A)
(B)
θTH
ΔθTH
スロットル開度制御
Δt
t
Pb
トルクショック
発生

【図１３】


(A)
(B)
θTH
ΔθTH
スロットル開度制御
Δt
t
Pb
トルクショック
発生